MAGNETIC ADAPTER

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application is a nonprovisional and claims the benefit of U.S. provisional patent application No. 62/235,146, filed Sep. 30, 2015, which is incorporated by reference.

BACKGROUND

[0002] The number and types of electronic devices available to consumers have increased tremendously the past few years and this increase shows no signs of abating. Electronic devices, such as portable media players, storage devices, tablets, netbooks, laptops, desktops, all-in-one computers, wearable computing devices, smart phones, televisions, monitors and other display devices, navigation systems, and other devices have become ubiquitous in recent years.

[0003] These devices often receive power and share data using various cables. These cables may have connector inserts, or plugs, on one or both ends. The connector inserts may plug into connector receptacles on electronic devices, thereby forming one or more conductive paths between devices for signals and power.

[0004] But these cables may create hazards. For example, a user may place an electronic device, such as a laptop, on a desk or table. The desk or table may be a distance from an electrical outlet. The user may plug a charger into the remote outlet and may plug a connector insert of the charger into a connector receptacle on the laptop. A power cord may then span the distance from the laptop to the remote outlet.

[0005] Particularly where the desk or table is in a public or semi-public environment, such as a library or coffee shop, the power cord may become a tripping hazard. When this occurs, a force applied to the cable may be transferred and applied to the connector insert. This inadvertent force on the connector insert may damage the connector receptacle, the electronic device housing the connector receptacle, or both. In more severe situations, the laptop may be pulled to the ground, thereby causing damage.

[0006] Thus, what is needed are components for connector systems such that when a connector insert is mated with a connector receptacle, damage to the connector receptacle and electronic device may be avoided in the event of an inadvertent force on the connector insert.

SUMMARY

[0007] Accordingly, embodiments of the present invention may provide components for connector systems such that when a connector insert is mated with a connector receptacle, damage to the connector receptacle and electronic device may be avoided in the event of an inadvertent force on the connector insert.

[0008] An illustrative embodiment of the present invention may provide a connector adapter having a connector insert and a magnetic connector receptacle. The magnetic connector receptacle on the adapter may receive a corresponding magnetic connector insert that may be connected to a charger through a cable. The connector insert of the adapter may be inserted into a connector receptacle on an electronic device. When an inadvertent force is applied to the magnetic connector insert of the charger via the cable, the magnetic connector insert of the charger and magnetic connector receptacle of the adapter may disengage, thereby preventing or limiting damage to the connector receptacle on the electronic device, as well as to the electronic device itself. This adapter may also allow users to use an existing charger with a magnetic connector insert to charge a new device having different connector receptacle.

[0009] These and other embodiments of the present invention may provide a connector adapter having a magnetic connector receptacle. The magnetic connector receptacle may include a plurality of magnets and a plurality of contacts. The contacts may include a center contact, ground contacts on each side of the center contact, and power contacts between the center contact and the ground contacts. The center contact may be a signal or detect or other type of contact. The contacts may be arranged in a symmetrical line. The contacts may be on a raised surface or portion surrounded by a recess. In these and other embodiments of the present invention, the magnetic connector receptacle may be a MagSafe connector receptacle. This may provide the breakaway protection of a MagSafe connector system for a device that does not include a MagSafe connector receptacle.

[0010] These and other embodiments of the present invention may provide a connector adapter having a connector insert, where the connector insert may be a Universal Serial Bus or other type of connector insert. For example, the connector insert may be a micro Universal Serial Bus connector insert, a Universal Serial Bus Type-C connector insert, or other type of Universal Serial Bus connector insert. The ground contacts and power supply contacts of the magnetic connector receptacle may connect to ground contacts and power supply contacts of the connector insert.

[0011] These and other embodiments of the present invention may provide a connector adapter having various components to facilitate the charging of the electronic device using the charger. For example, a pull-down resistor may be connected between the center contact of the MagSafe connector receptacle and a ground contact. This resistance may be detected by the charger, after which the charger may provide power with a low series impedance to the MagSafe connector receptacle of the adapter. It should be noted that contacts of a Universal Serial Bus connector insert are covered such that contacts carrying voltages are not directly exposed when the adapter is connected to the charger but the connector insert of the adapter is not inserted in the electronic device. In these and other embodiments of the present invention, a pull-up resistor may be coupled between a connection detection contact of a Universal Serial Bus Type-C connector insert and a power supply contact of the MagSafe connector receptacle. The Universal Serial Bus Type-C connector receptacle on the electronic device may detect this pull-up resistor and determine that it is connected to a power providing device. In this case, the Universal Serial Bus Type-C connector receptacle may not provide power but may be configured to receive power from the charger through the adapter.

[0012] While embodiments of the present invention are well-suited for connector adapters, in other embodiments of the present invention, the MagSafe connector receptacle and USB Type-C connector insert may be connectors on a dongle or cable adapter that may also include one or more additional connector receptacles, such as an High-Definition Multimedia Interface® connector receptacle, a Video Graphics Array (VGA) connector receptacle, and other types of connector receptacles.